Earth Science and the Global Grid
The ESIP Federation Today

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Federation of Earth Science Information Partners
The Foundation for Earth Science

June 8, 2005

Some Expert Observations:

"The great challenge of Grid computing is the complete integration of diverse computing systems and data resources to provide *a global computing space*. This will bring revolutionary changes in the field of computation…"

Announcement, 2nd Int'l Workshop on Grid Computing and its Application to Data Analysis (GADA'05), Cyprus, 31 Oct – 4 Nov 2005

"All revolutionary advances in scientific computing have had one thing in common: a deep partnership between a pioneering scientist and an IT peer."

– Joel Moses, AI Pioneer, MIT, 1972

"We must embrace a revolutionary expansion of the conceptual model that governs EOSDIS by affording the scientific community full partnership."

– NRC Report on USGCRP, 1995

From the 1995 NRC Report on USGCRP*

"Responsibility for product generation, publication, and user services should be held by a *federation of partners* selected through a competitive process"

"the resulting system must enable science community interaction and electronic dissemination of results"

"the federation must include other agencies and the research teams they support"

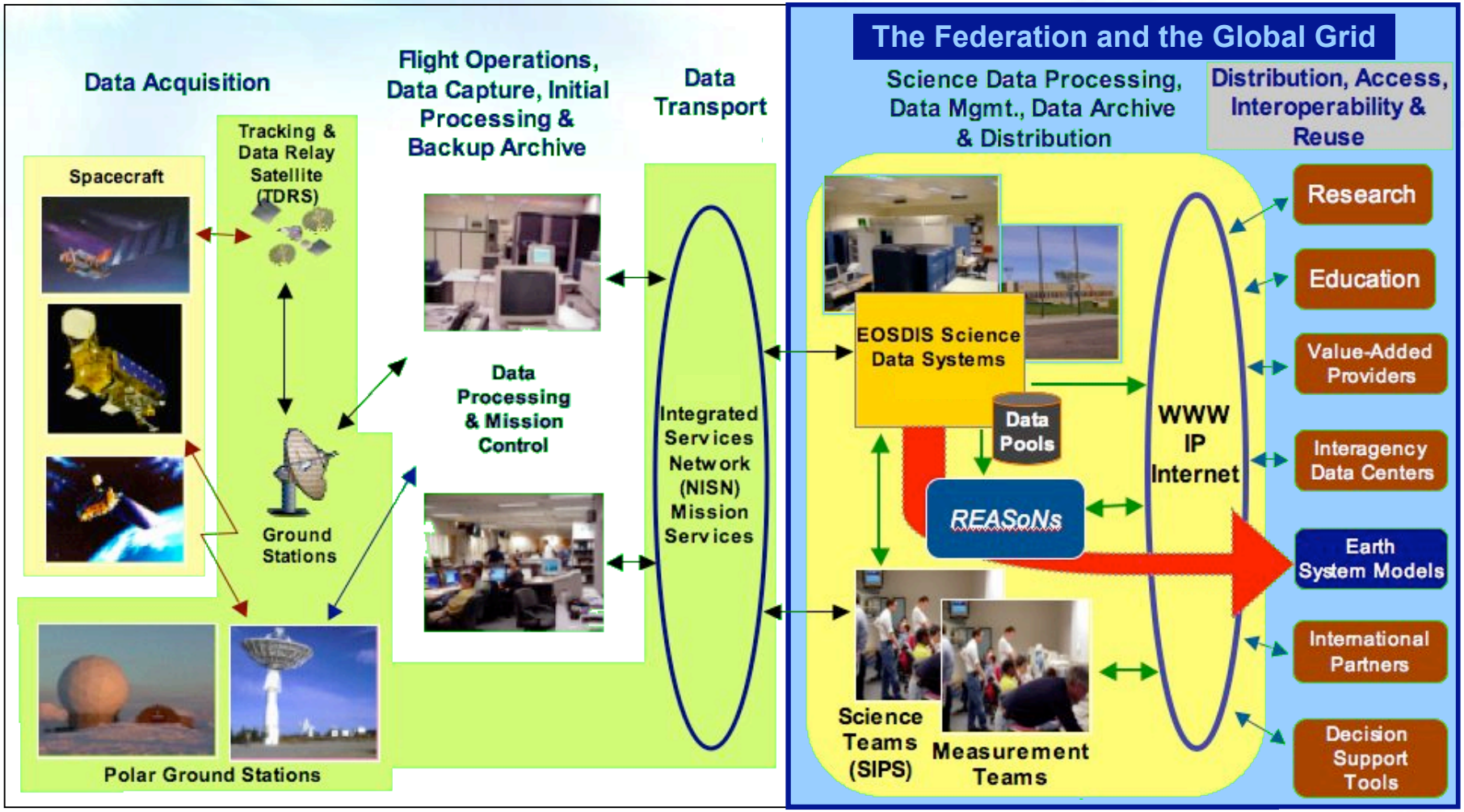
"it will extend EOS data access to a wide audience, including new participants in the private sector"

"it will generate a new approach to the interactive management and use of distributed data sets"

"success depends in part on the viability of the Internet as a mechanism for high-bandwidth computer-to-computer communication"

*A Review of the U.S. Global Change Research Program and NASA's Mission to Planet Earth/Earth Observing System. National Academy Press, 1995, 96 pp.

Science Data System Architecture



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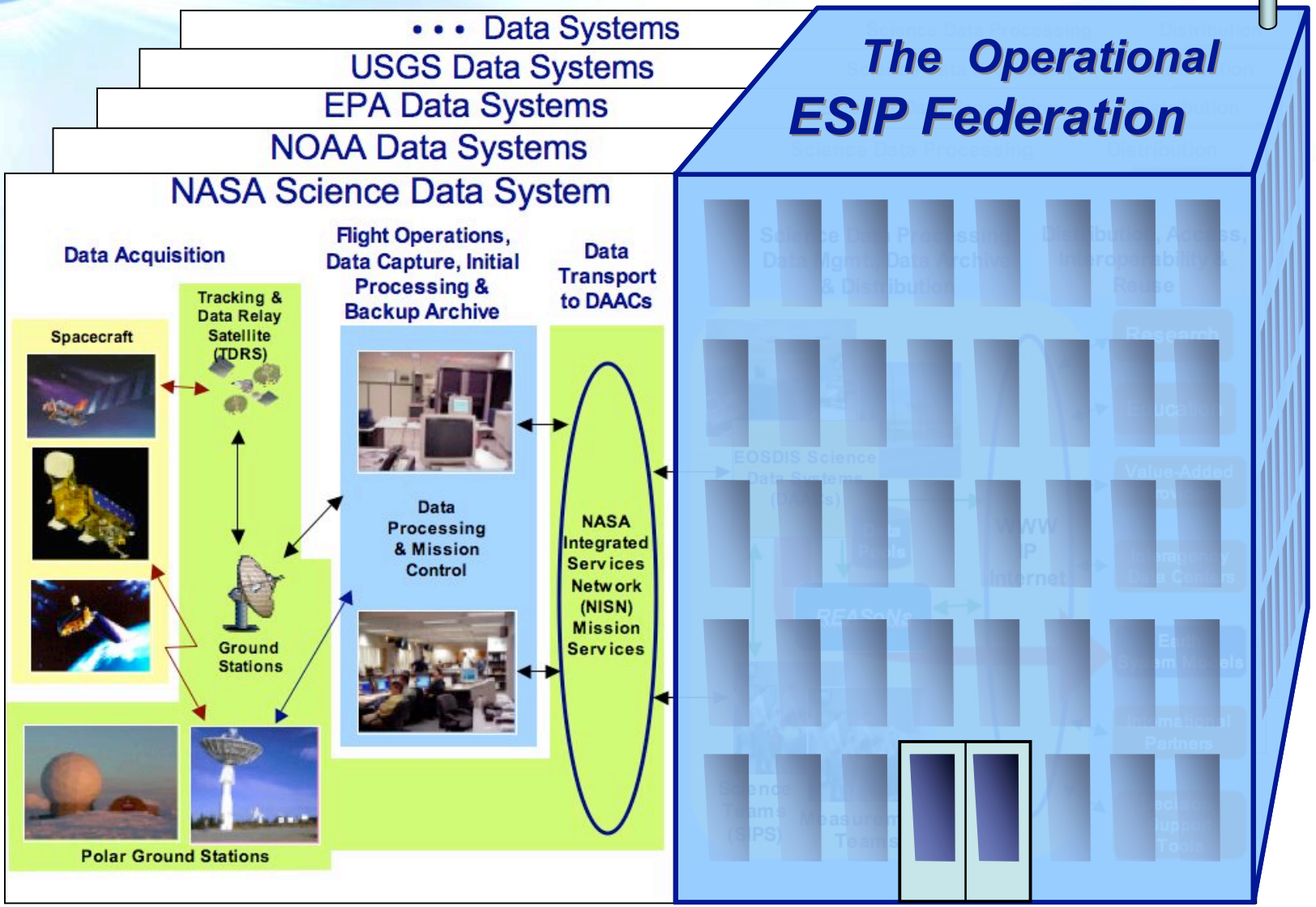
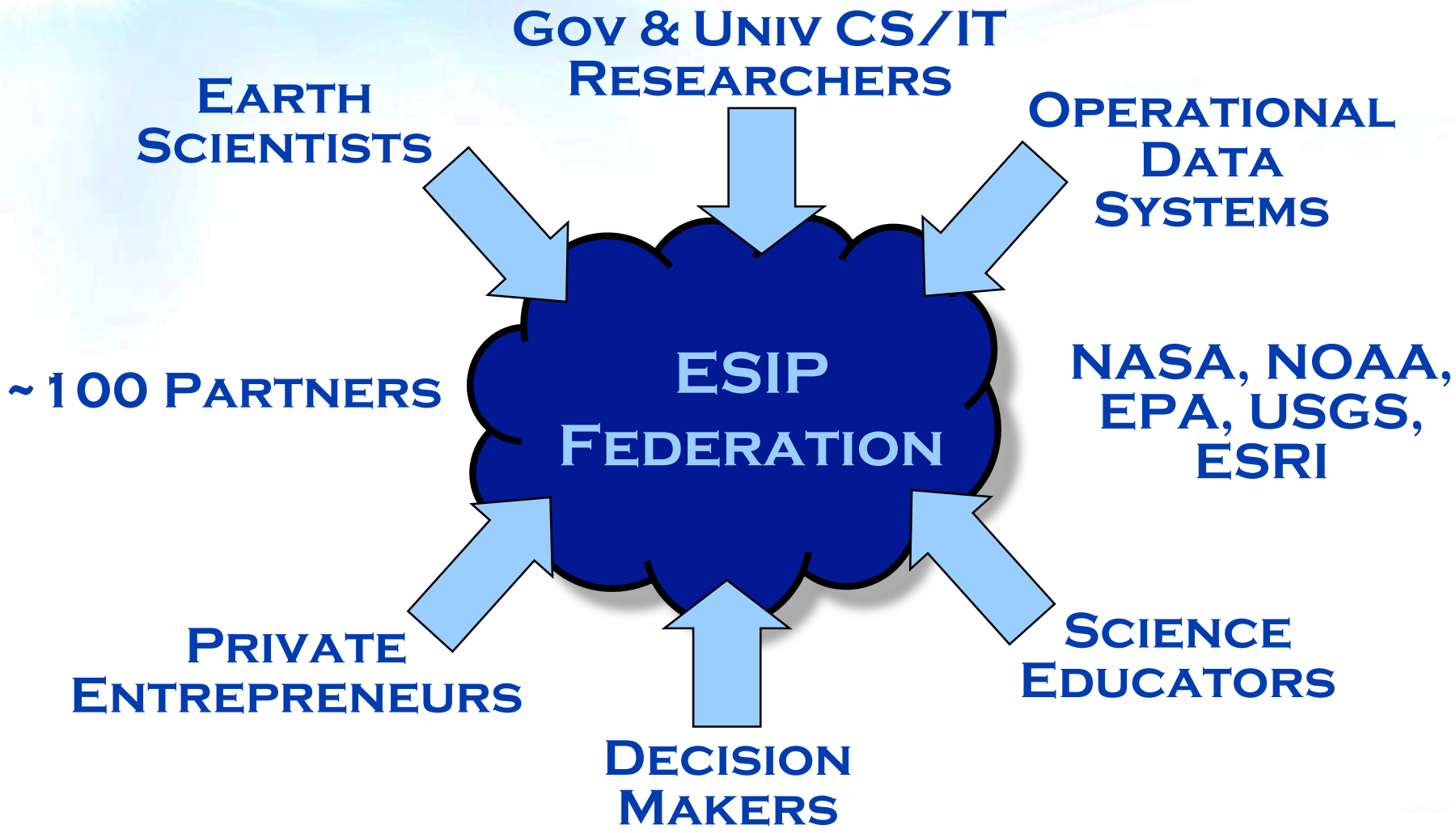
Expanding Federation Base




Earth Information on the Global Grid
The NEW
ESiP
FEDERATION
Science • Applications • Decision Support

The ESIP Federation Today



Unifying Characteristic:

A shared interest in applying advanced Information Technology in the service of responsible environmental stewardship

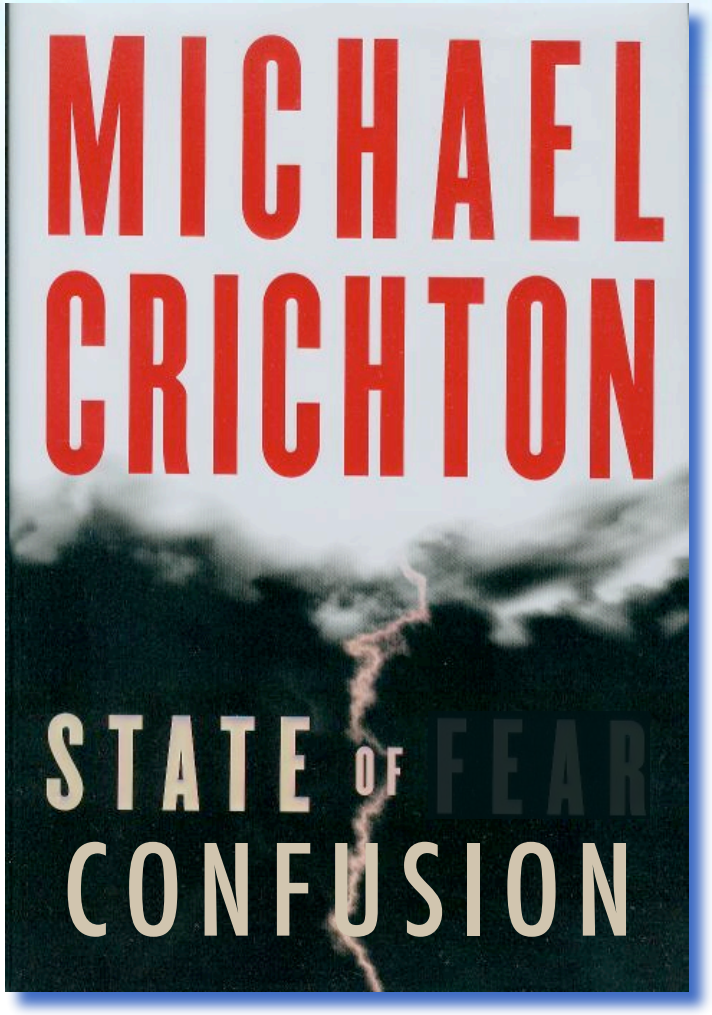
Federation Mottos:

“Achieving a sustainable world”

“Making data matter”

Saving Swiss Glaciers

From the Literature…



Fictional Govt. Program Mgr:

"…we're in the middle of…a global war of information versus disinformation [regarding climate change]." (p. 48)

How do we pursue our vision?

(1)

Put *reliable* information into the right hands

(2)

Do it ***actively***

Major Federation Goals

1. Serve as facilitator and advisor for the Earth science information community.
2. Promote efficient flow of Earth science data from collection to end-use.
3. Improve quality and usability of Earth science data and information systems.
4. Expand the use of Earth science information – get it into the hands of decision-makers.
5. Educate the public about Earth science and science information systems.

Going Operational

Some Current Federation Activities

- Building a Master Portal – An IT Technology Showcase
  - A first incarnation of the NRC vision – and more
  - An infusion point for emerging tools and services
  - An entry point for Earth Science on the Global Grid
- Launching an aggressive Decision Support program
- Releasing a Web Services Technology Roadmap
- Taking a strong role in the Earth Science DSWGs
- Building new sponsorship, agency and commercial
- Expanding public outreach and education
- Building strategic alliances with like-minded groups:

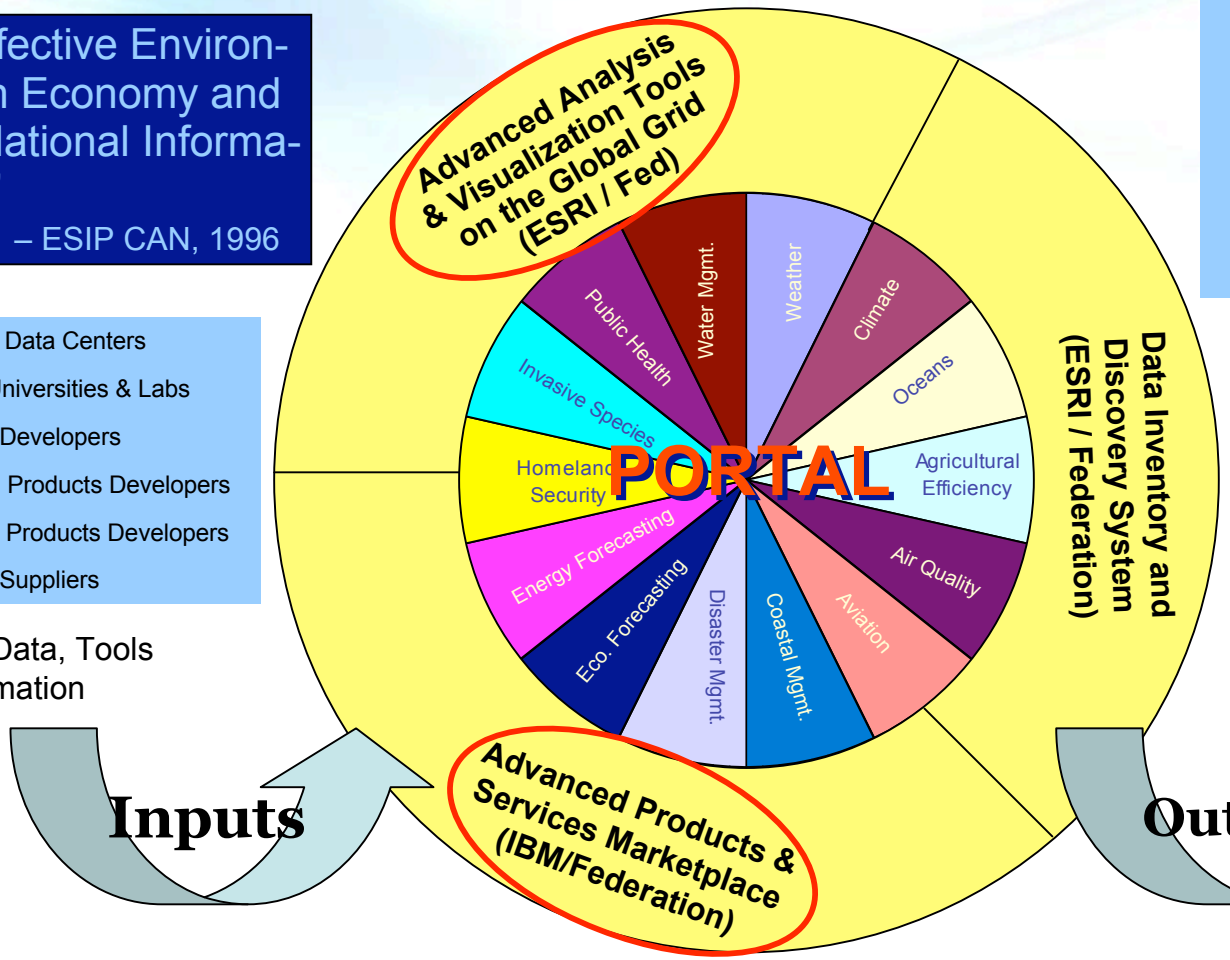
  NCSE, Heinz Foundation, UCAR/NCAR, …

The Earth Information Exchange

"Help create an effective Environmental Information Economy and contribute to the National Information Infrastructure"
– ESIP CAN, 1996

- NASA, NOAA & USGS Member Data Centers
- Federation Member Research Universities & Labs
- Federation Member Application Developers
- Federation Member Educational Products Developers
- Federation Member Technology Products Developers
- Non-Member Data and Product Suppliers

Science-based Data, Tools and Information



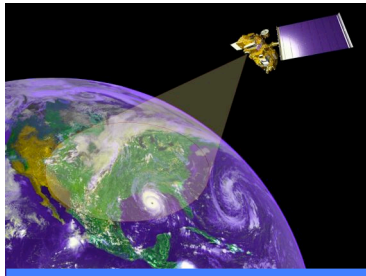
Inputs

Outputs

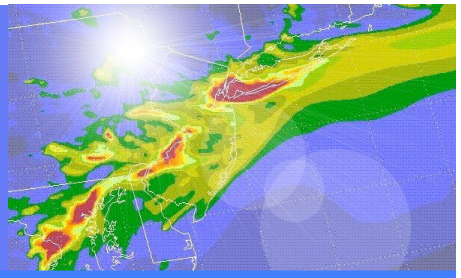
Usable Earth Science and Environmental Information

- **Decision Makers**
- **GIS Users**
- **Teachers**
- **Researchers**
- **General Public**

"This will stimulate participation of the scientific community and create a model for the broader Global Change Information System." – NRC, 1995

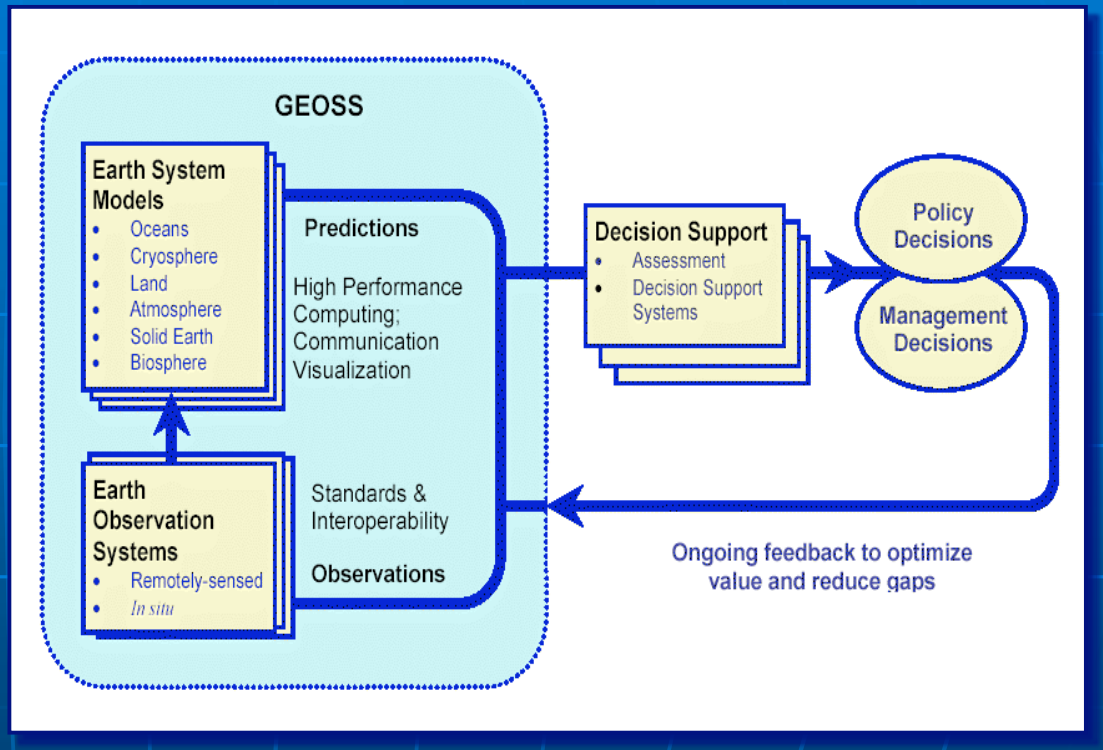


U.S. EPA's GEOSS Remote Sensing Information Gateway



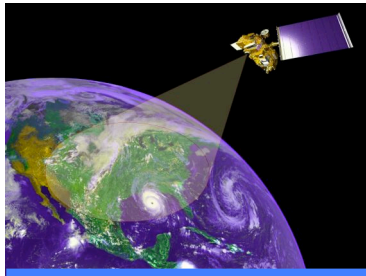
The Challenge:

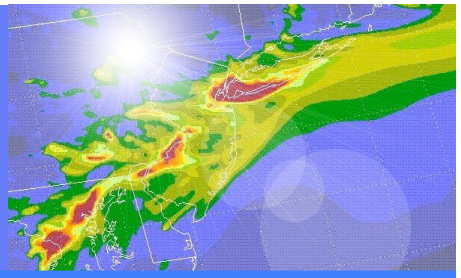
- Combine data usefully at diverse temporal and spatial scales;
- Transform data into knowledge;
- Map knowledge into agency decision support systems;
- Thereby, improve the science foundation of environmental decisions.

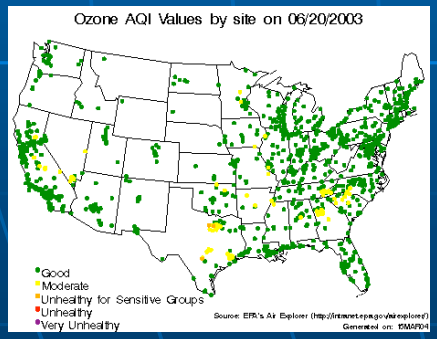


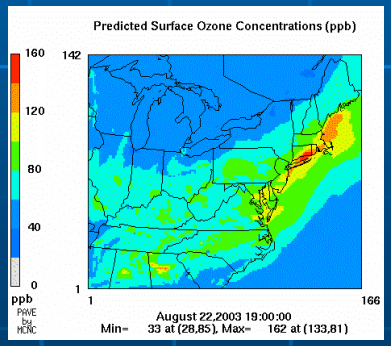
The Goal: Develop a Distributed Data & Modeling Center with initial applications to support Air Quality Program Goals

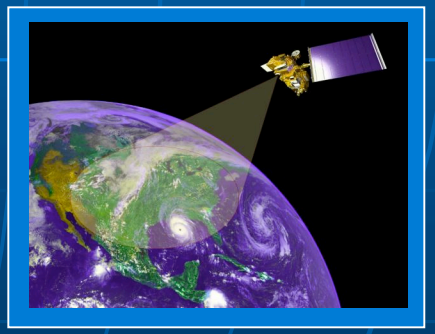
Partnerships in Characterizing Air Quality









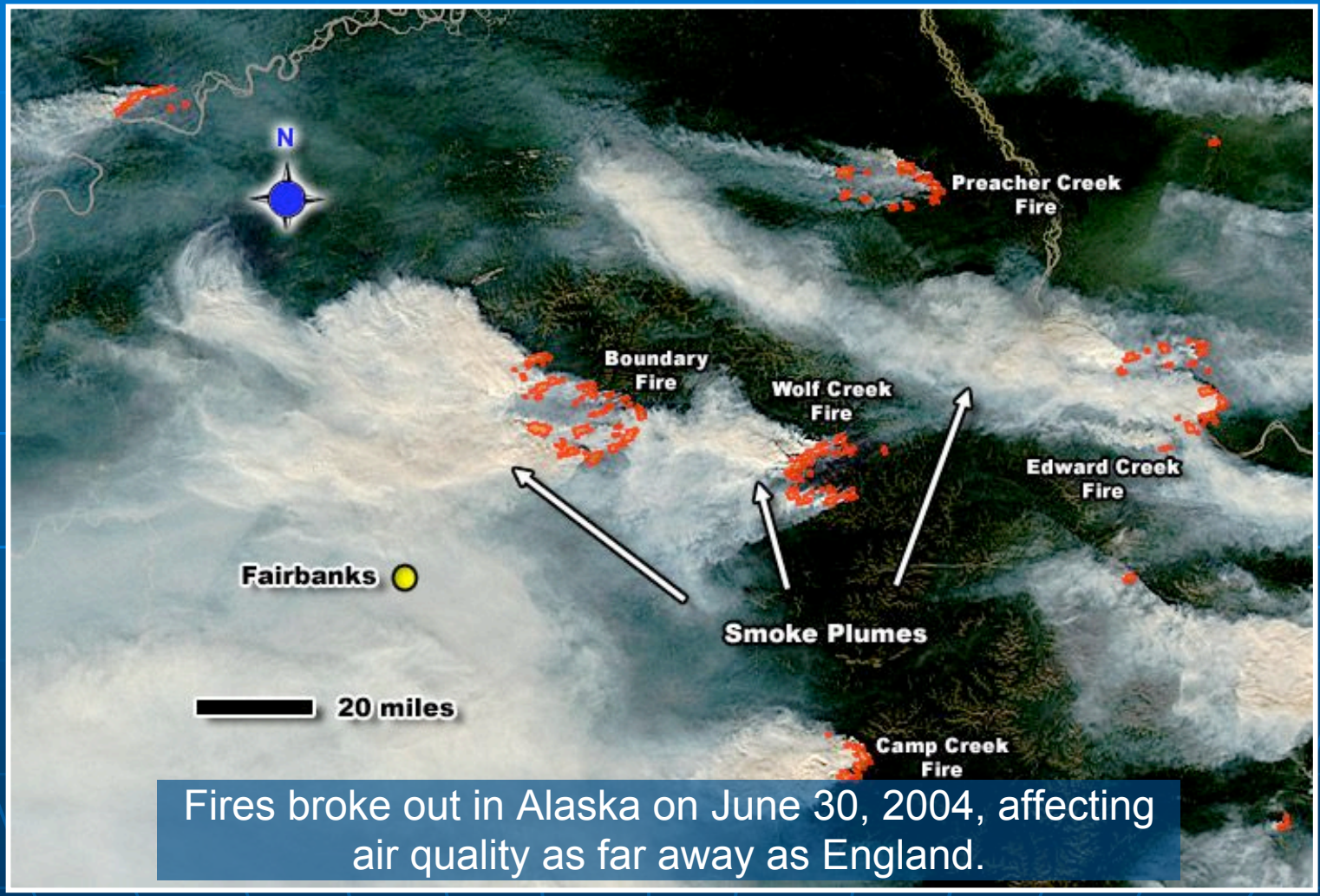


Monitoring ⟷ Modeling ⟷ Satellite

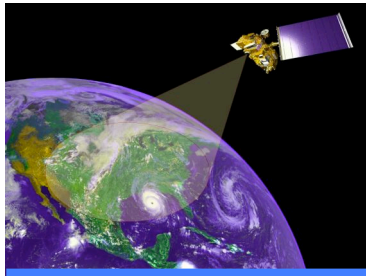
Research & Development

Building a science foundation for sound environmental decisions

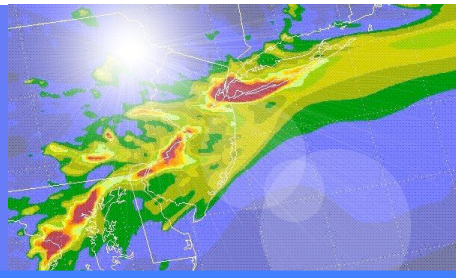
2004 Alaskan Fires Illustrate Value of Integrating Diverse Air Quality Datasets

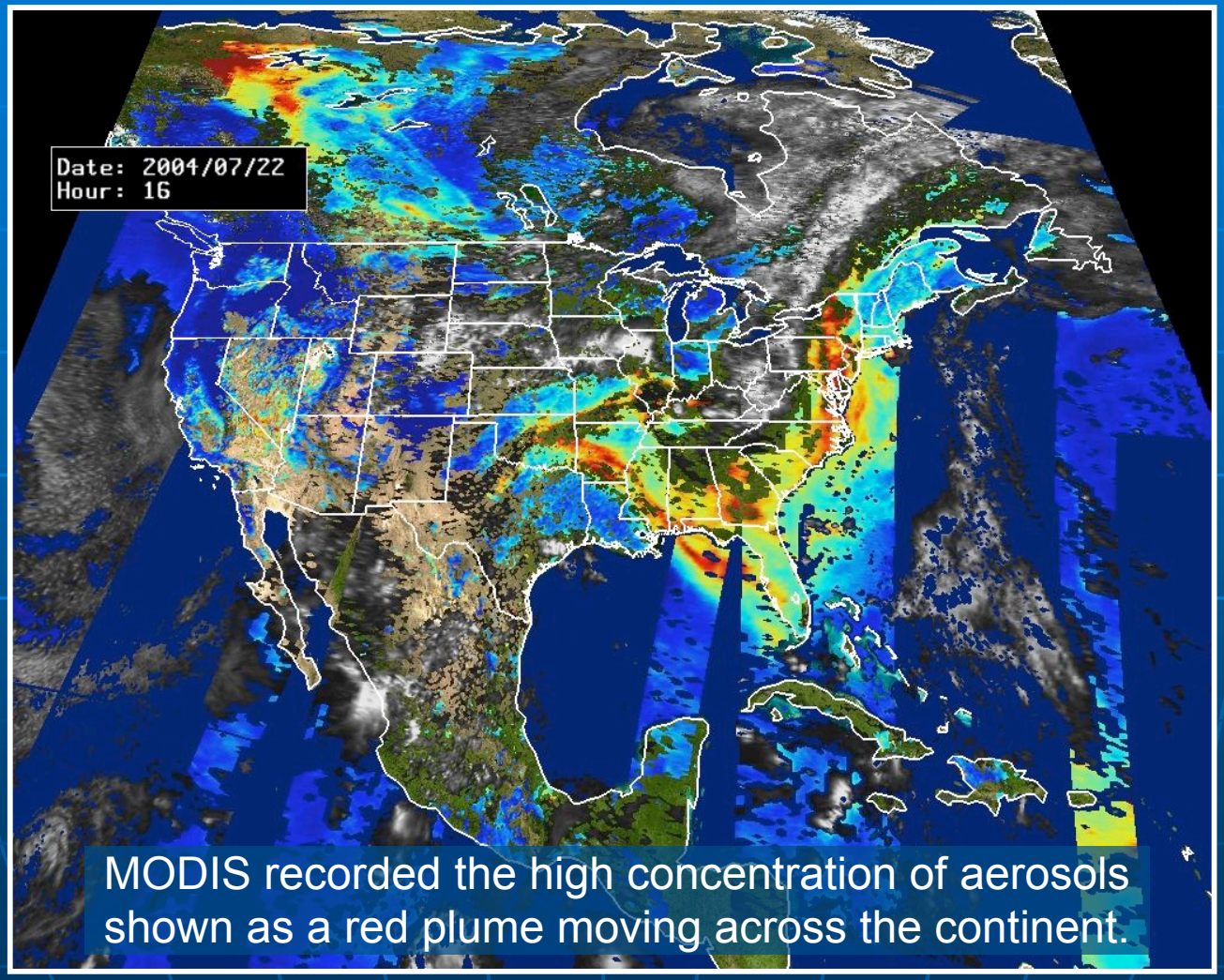


Fires broke out in Alaska on June 30, 2004, affecting air quality as far away as England.



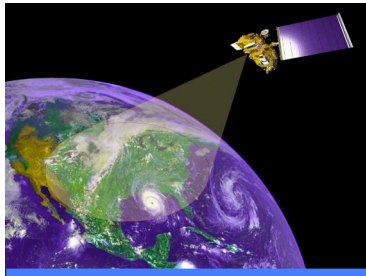
NASA's MODIS (on Terra) Sensed the Fires from Above

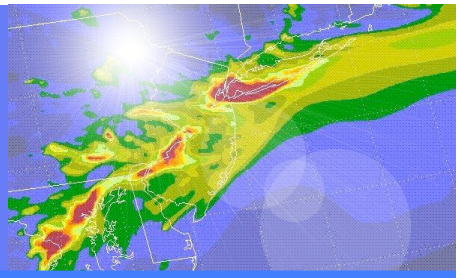


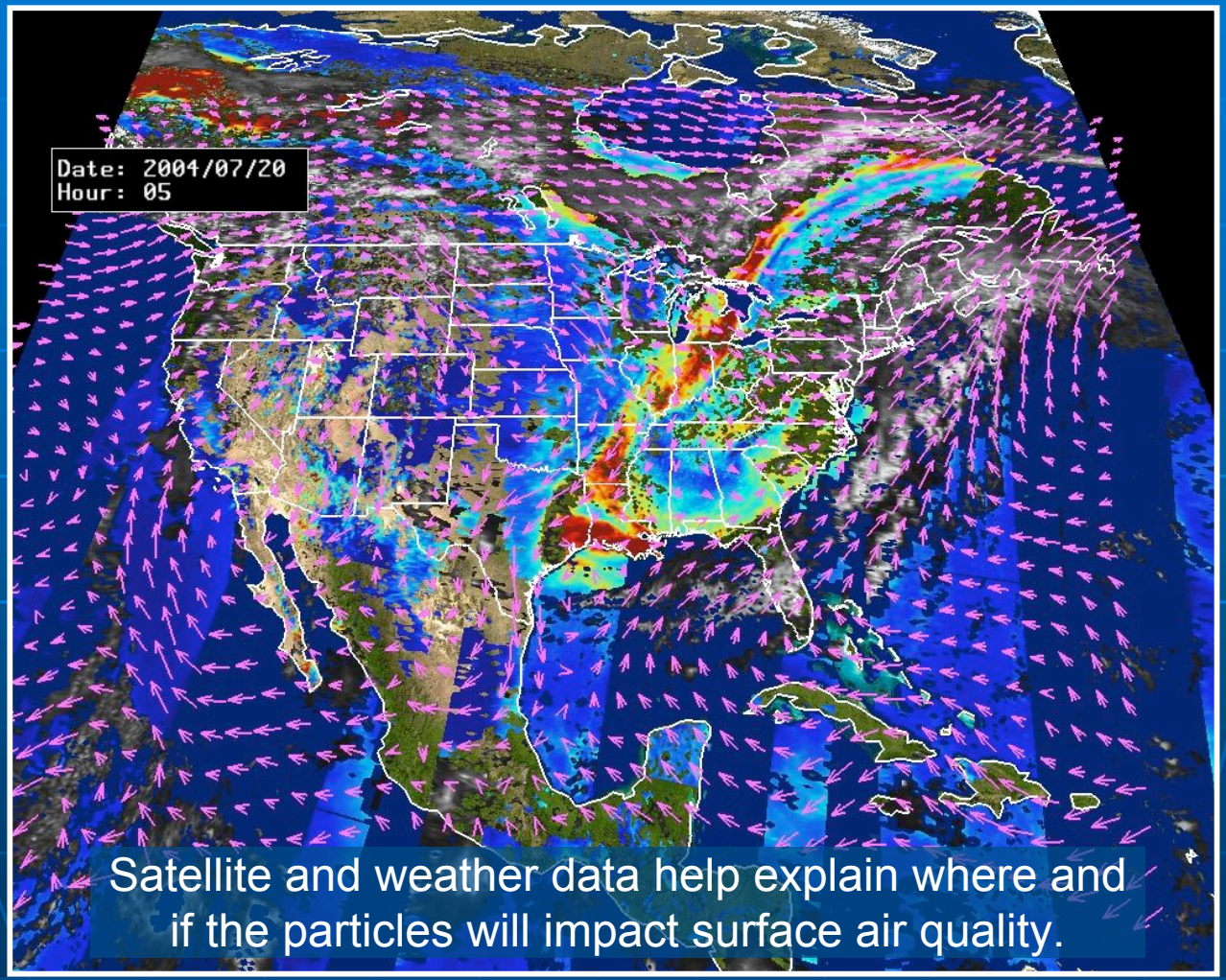


MODIS recorded the high concentration of aerosols shown as a red plume moving across the continent.

NOAA Weather Data Helps Explain Plume Movement

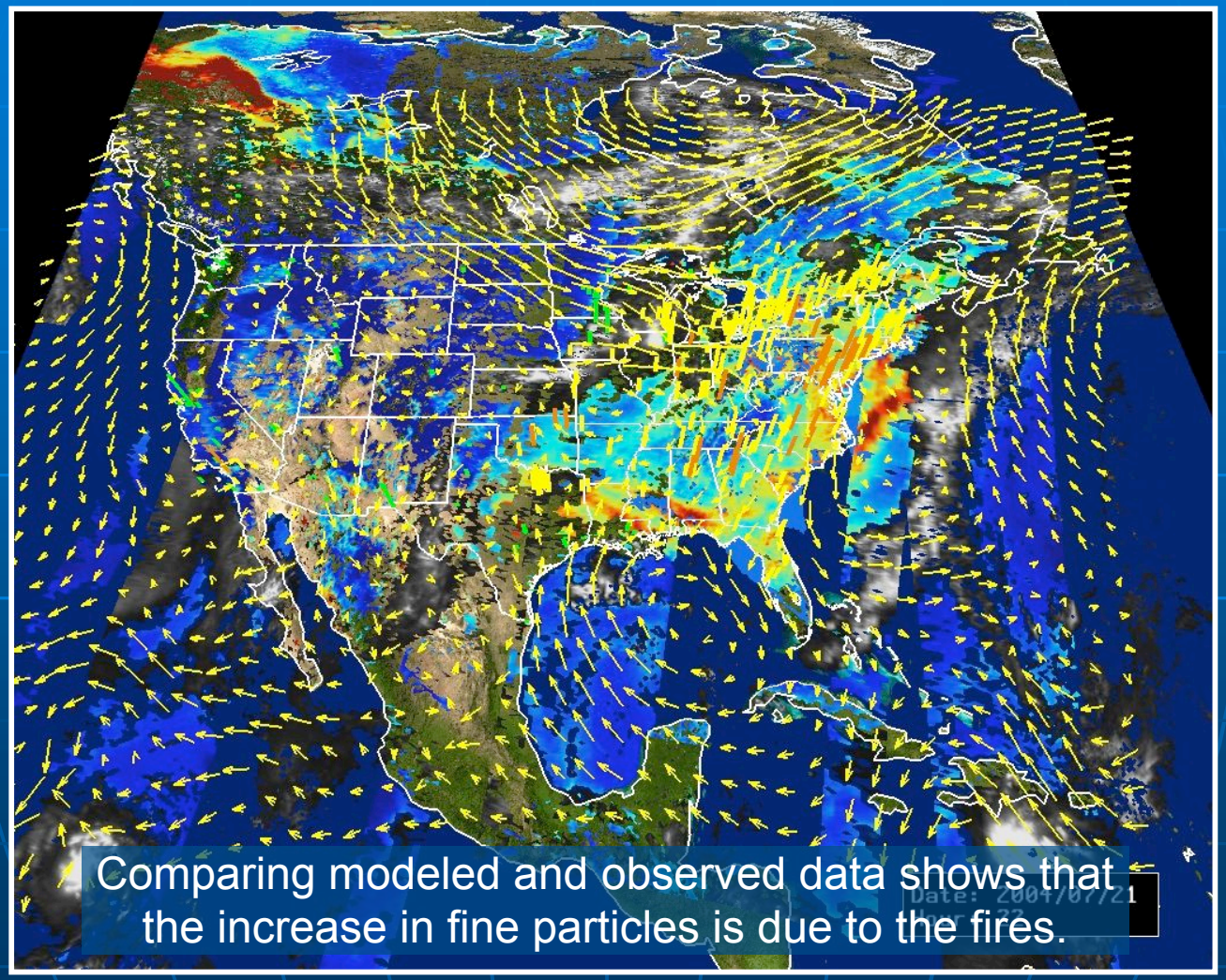






Satellite and weather data help explain where and if the particles will impact surface air quality.

EPA/NOAA Model Estimates Fine Particles in Absence of Fire Inputs



Comparing modeled and observed data shows that the increase in fine particles is due to the fires.

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The EiE Will Reside Within the Geospatial One-Stop Portal

Clusters/Committees

- Standards
- Air Quality
- Disaster Management
- Eco-Forecasting • • •

Coming Features

- Earth Science on the Global Grid
- The Global Geoscience Grid
- Wormhole to the Future

Applications

- Air Quality Managem't
- Agricultural Efficiency
- Aviation
- Climate
- Coastal Management
- Disaster Management
- Eco-Forecasting
- Energy Forecasting
- Homeland Security
- Invasive Species
- Oceans
- Public Health
- Water Management
- Weather

Science

- Atmospheric Chem
- Carbon Cycle
- Climate Change
- Earth System
- Earth-Sun System
- Ecosystems
- Energy Cycle
- Natural Hazards
- Planetary Studies
- Solid Earth
- Water Cycle
- Weather

Data Products

- All Earth Data Products
- NASA Earth Products
- Dept of Energy Data
- EPA Data Products
- Forestry Data Products
- NOAA Data Products
- NSF Earth Products
- Planetary Datasets
- USGS Data Products
- • • •

Education

- Adult Ed Prods & Serv
- College Prods & Serv's
- Curriculum Developm't
- DLESE
- Graduate Prods & Serv
- K-12 Prods & Services
- Media Services
- Museums
- • • •

Analysis Tools

- Data Discovery
- Data Fusion
- Data Mining
- Data Compression
- Statistical Analysis
- Visualization
- • • •

Decision Tools

- Air Quality
- Coastal Management
- Eco-Forecasting
- Public Health
- • • •

Federation Decision Support

Application Focus Groups Now Underway:

- Agricultural Efficiency
- Air Quality Management
- Carbon Management
- Aviation
- Coastal Management
- Ecological Forecasting
- Disaster Management
- Homeland Security
- Invasive Species
- Public Health
- Water Management
- Energy Preservation

GEOSS Focus Areas: Weather, Climate, Oceans

Conclusions

- The 1995 NRC Vision is becoming a reality

Beyond that vision, the Federation is:

- Providing an entry point to the Global Computing Grid for Earth Science and Applications
- Providing advanced analysis tools for Earth Science and environmental decision support
- Actively engaging decision makers to bring them the most current information and tools

From Our Advisors

"There is nothing more difficult, more perilous, more uncertain of success, than to advocate a new order of things. For the innovator has fierce enemies in all who do well under the current system, and only mild defenders in those who may profit under the new. This coolness comes partly from fear of the opponents, who have authority on their side, and partly from the incredulity of men, who do not readily believe in new things…."

– Machiavelli, *The Prince*, 1513

"There is only one thing more powerful than all the armies of the world – that is an idea whose time has come."

– Victor Hugo, c. 1850

Backups

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Partial List of Federation Partners

- Alaska Satellite Facility
- Arizona Regional Image Archive
- Basic and Applied Spatial Information Collaborative
- Basic Science & Remote Sensing Init
- Brigham Young University
- California State University at Long Beach
- California Resources Agency
- California State University - Monterey Bay
- Center for Earth Observing and Space Research at George Mason University
- Center for Geographic Information & Analysis
- Center for International Earth Science Information Network at Columbia University, Socioeconomic Data Center
- Colorado State University
- Digital Image Analysis Laboratory at Scripps Institution of Oceanography
- Digital Library for Earth System Education
- Earth Data Analysis Center at University of New Mexico
- Earth System Science Education 21st Century

Partial List of Federation Partners (cont.)

- EOSDIS Distributed Active Archive Center
- Florida International University
- General Dynamics Information Systems
- Global Hydrology Resource Center
- GLOBE Program
- Graduate School of Oceanography, University of Rhode Island
- IBM
- Immersive Earth at Rice University
- Integrating NASA Earth Science Enterprise Data into Global Agricultural Decision Support Systems
- Jet Propulsion Laboratory
- Kentucky Governor's Office for Technology
- Laboratory for Advanced Information Technology and Standards at George Mason University
- Museum of Science (Boston)
- Museums Teaching Planet Earth
- NASA Ames Research Center

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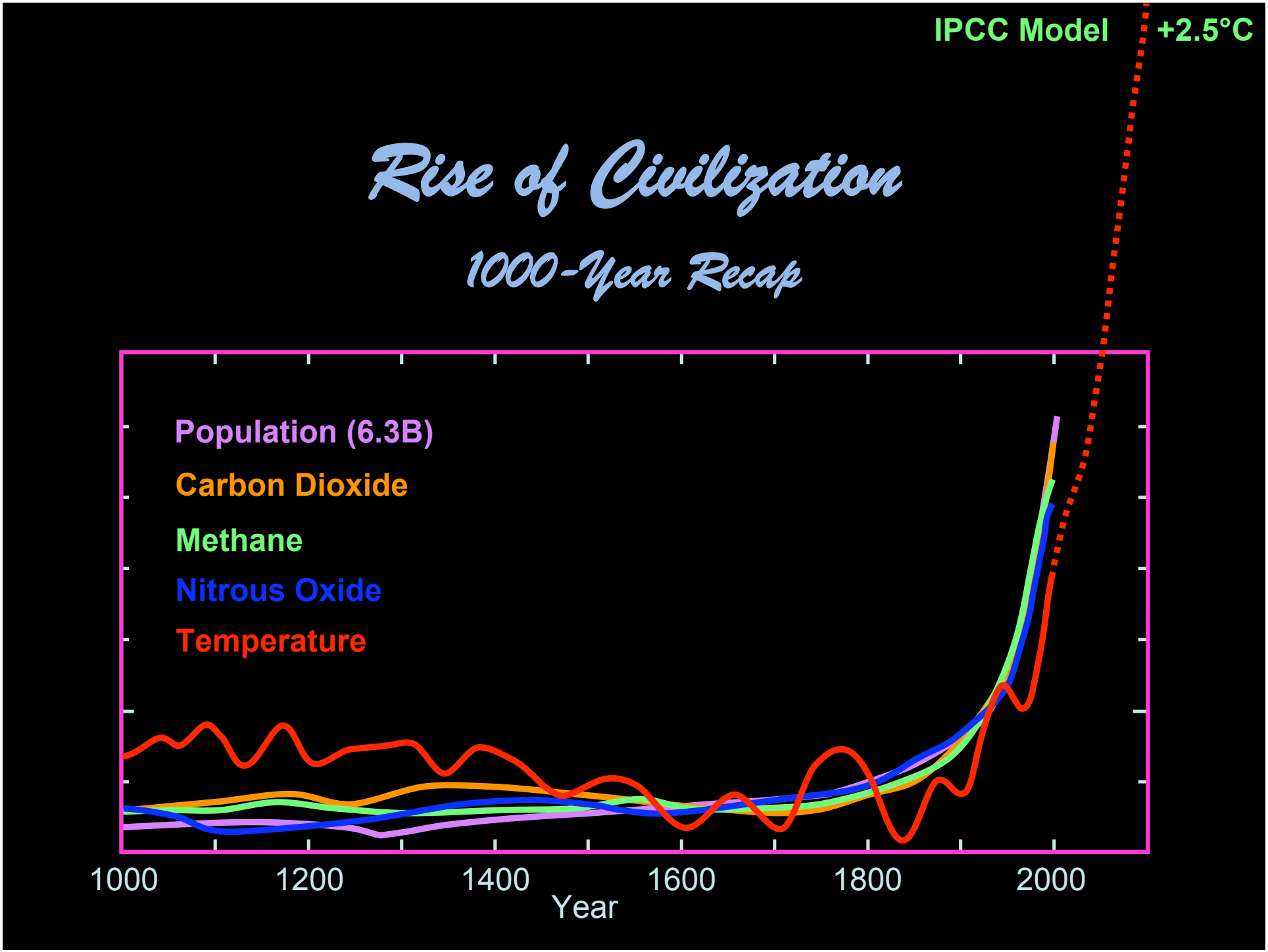
Partial List of Federation Partners (cont.)

- NASA Earth-Sun System Division
- NASA Goddard Data Center
- NASA Goddard Institute for Space Studies
- NASA Goddard Space Flight Center
- NASA Langley Research CenterNOAA's National Climatic Data Center
- NOAA's National Geophysical Data Center
- NOAA's National Oceanographic Data Center
- National Space Science and Technology Center
- NatureServe
- New Media Studio
- National Snow and Ice Data Center
- Oak Ridge National Laboratory
- Reading Information Technology Inc.
- Remote Sensing Systems
- San Diego State University
- Scientific Fishery Systems
- StormCenter Communications
- Tactical Geographics, L.L.C.

Partial List of Federation Partners (cont.)

- TERC
- University of Alabama - Huntsville
- University of California
- University of California at Berkeley
- University of California at Santa Barbara
- University of Connecticut Cooperative Extension System
- University of Kansas
- University Maryland - Baltimore, Computer Science & Electrical Engineering Department
- University of Maryland
- University of Minnesota
- University of Montana
- University of New Hampshire
- University of North Dakota Center for Aerospace Sciences
- University of South Carolina
- University of Wisconsin, Space Science and Engineering Center
- U.S Geological Survey, EROS Data Center
- U.S. Satellite Laboratory
- Unidata
- Washington University


IPCC Model
+2.5°C
Rise of Civilization
1000-Year Recap
Population (6.3B)
Carbon Dioxide
Methane
Nitrous Oxide
Temperature
1000
1200
1400
1600
1800
2000
Year

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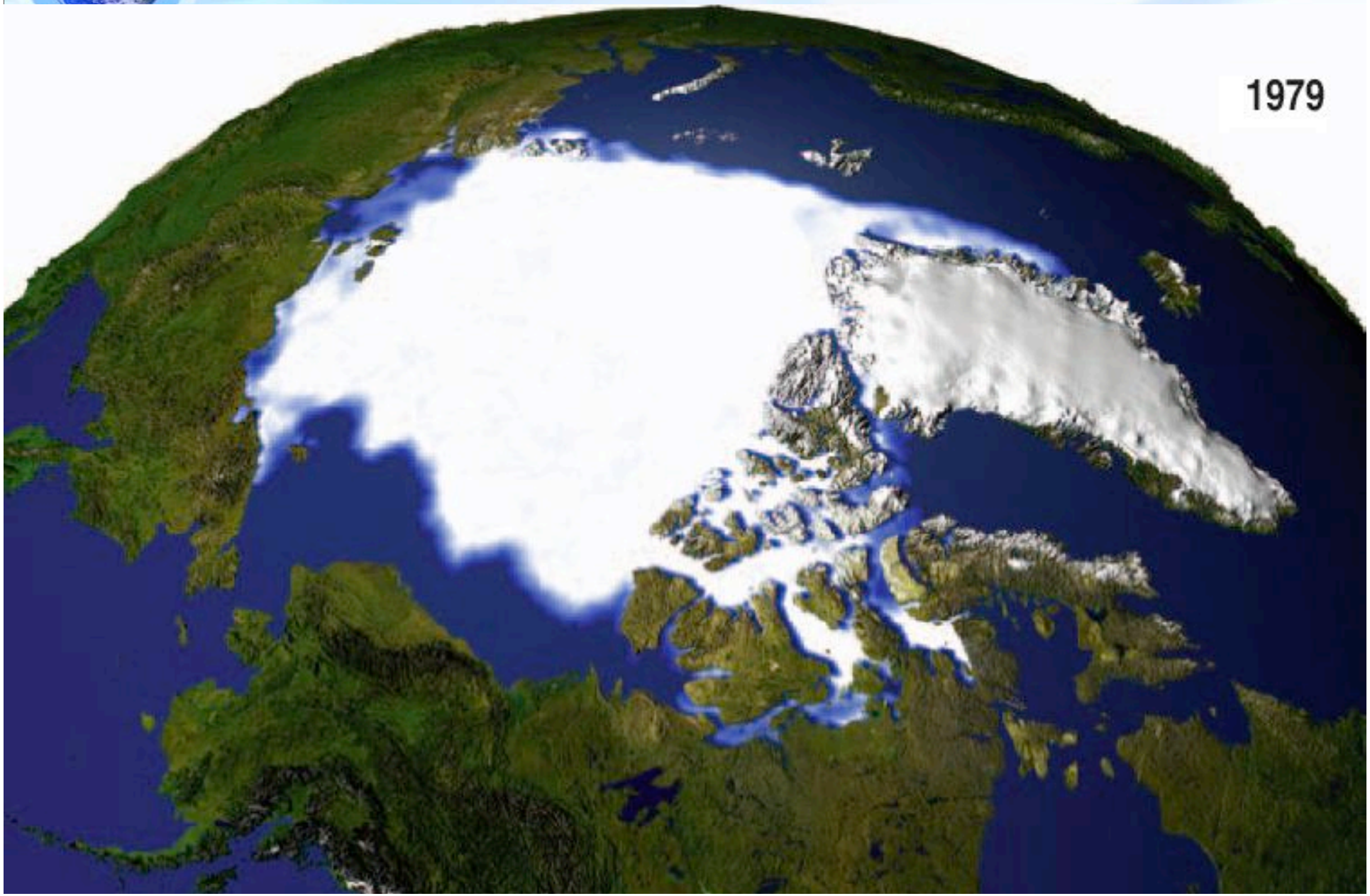

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